

Disasters, the Environment, and Public Health: Improving Our Response

ABSTRACT

Natural and human-made disasters continue to adversely affect all areas of the world in both predictable and unpredictable ways. To highlight the importance of natural disasters, the United Nations declared the 1990s the International Decade for Natural Disaster Reduction. This paper considers the public health response to disasters. It highlights environmental health issues and approaches since disasters are extreme environmental events, and it reviews developments relating to capacity building, training, and collaboration. Although progress is noted, a comprehensive federal or academic approach is not evident in the United States and the proper linkage to environmental health is lacking. With the International Decade now half over, public health professionals and others involved with disaster management should reflect on progress made to date and goals for the future. (*Am J Public Health*. 1996;86:1207-1210)

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Introduction

The 1990s have been declared the International Decade for Natural Disaster Reduction. Nevertheless, natural and human-made/technological disasters have adversely affected human health during this period, both predictably and unpredictably. Although the intense 1995 hurricane season may have been anticipated, who could have predicted the terrorist bombing in Oklahoma, Chicago's spate of heat-related deaths,¹ or Pennsylvania's blizzard/flood disaster during 1995/1996? The public health significance of disasters has recently been highlighted. In 1994, a work group representing public sector and professional organizations defined six core public health responsibilities, including disaster response and assistance to communities in recovery.² Epidemiological and public health reviews of disasters also emphasize their importance.³⁻⁸

Disasters and Environmental Health

Disasters are extreme environmental events that cause excess morbidity and mortality; they represent a category of environmental agents. Recent public health reviews have taken a global approach to studying significant environmental health threats,⁹⁻¹² such as the exponential growth of human populations and increased greenhouse gases. Although disasters also belong in this category of global threats, they have received little consideration in environmental health reviews or strategy documents that can influence funding or other types of support. For example, the US Department of Health and Human Services selected 16 environmental health objectives, including one on hazardous waste sites, as part of the Year 2000 objectives.¹³ However,

disasters were not selected. Although extensive research has been conducted on the public health response to disasters and environmental health, the proper linkage between the two has not been made. In an attempt to address this situation, Dr Vernon Houk, former director of the National Center for Environmental Health (NCEH), spoke in 1992 on "The Role of Environmental Health Protection in Public Health Agencies."¹⁴ He highlighted fundamental issues facing environmental health programs—setting priorities, solving capacity and funding problems, and evaluating programs—and chose land-use planning to illustrate a pressing environmental problem. He identified the need for such planning to reduce disaster hazards, such as those associated with Hurricanes Andrew and Iniki. And while the lack of comprehensive land-use planning is only one risk factor, his remarks gave visibility to the more general concern for disasters.

In 1995, a 6.9-magnitude earthquake struck various Japanese cities, particularly Kobe, destroying many homes and businesses, and causing many fatalities and huge financial losses. The losses were associated with the rupture of a secondary fault and sizeable numbers of people living in danger zones.¹⁵ Other disasters, including flooding, have affected Kobe residents in the past, and these events may have caused a false sense of security about the likelihood of earthquakes.¹⁶ Many lessons can be learned from this event.

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For instance, the construction of typical Japanese houses can be modified by using lighter roofing.¹⁷ Moreover, there is a need for sound urban policies and public education¹⁸ in addition to up-to-date building codes.¹⁶ These lessons can apply to other situations and underscore the need for vigilance in California¹⁹ and other earthquake-prone states.²⁰

The 1989 Loma Prieta and 1994 Northridge earthquakes in California sensitized the US scientific community to this hazard.²⁰⁻²⁴ Earthquakes can cause dramatically different casualty rates, depending on their location.^{20,22} Although high casualty rates are expected in developing countries, the 5500 Kobe deaths¹⁷ were unexpected because of Japan's extensive earthquake preparedness. However, low casualty rates should not obscure other effects, such as injuries and other potential physical and mental sequelae. The Loma Prieta event caused 62 deaths and 3757 injuries,²¹ and the Northridge event caused 33 deaths and more than 7000 injuries.²⁴

Regardless of an area's level of preparedness, natural disasters should always be expected.²² Unfortunately, public/political attention to disasters appears shortsighted although the rewards of such activity can be cost-effective.²⁰

Public Health Response to Hazardous Waste Sites: Possible Lessons

Because of significant problems with hazardous waste sites in the 1970s, including Love Canal, the US Congress enacted the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (the Superfund Law) to address this issue. In fact, Love Canal was declared a federal "emergency" disaster in 1978 and 1980, before the federal Superfund program was created.²⁵

The Agency for Toxic Substances and Disease Registry was established as a result of the Superfund Law to evaluate public health issues associated with hazardous waste sites. Since its creation, the agency has implemented many worthwhile measures,²⁶ including public health assessments, which are initial evaluations of available data for a site; public health education; and follow-up health activities. Excellent guidance is available to state health departments participating in the agency's Public Health Assessment Cooperative Agreement Program and to others as well.²⁷ Clearly, the agency has orchestrated a comprehensive public health response to hazardous waste sites. Although aspects of the Superfund program have been questioned,^{9,28} there is little doubt

that hazardous waste sites represent significant environmental health problems.

Recurring disasters represent similar threats, but they have not resulted in a comprehensive public health response. The experience of the Agency for Toxic Substances and Disease Registry with the Superfund program can have important implications regarding public health's role in overall disaster management.

Practical Public Health Approaches

Recently, the overall approach to disasters has shifted from haphazard postdisaster response to more systematized disaster management that emphasizes prevention.⁷ This approach should be a priority of disaster epidemiology and related fields. Epidemiological studies of disasters have led to new discoveries and important environmental and policy changes.²⁹ For example, a recent study of housing injuries in the 1990 Plainfield tornado revealed higher risks of injury from newer homes, particularly those built after 1972.³⁰ The study highlighted the need for adequate building codes and construction methods in tornado-prone regions. Another study linked the problem of an increased incidence of neural tube defects in Jamaica following Hurricane Gilbert with a diet low in folate in the periconceptual period.³¹ Although the findings of that study have significant dietary implications for women in general, they also demonstrate the need for women in disaster-affected areas to maintain proper dietary intake during postdisaster periods.

Numerous practical applications of epidemiology have also contributed to the scientific basis of disaster management. For example, in 1993 the Iowa Department of Public Health requested technical assistance from the Centers for Disease Control and Prevention (CDC) in implementing the Emergency Computer Communications Network following devastating flooding.³² The CDC assisted Iowa with postdisaster needs assessment and surveillance by rapidly establishing an electronic reporting system and providing e-mail communications linking local health departments. The system also contributed to Iowa's long-term public health/disaster response capability.

Environmental Lessons at the Local Level

Geography plays a major role in public health and disaster management. Key geographic issues are homesteads and other places, such as work locations

or schools, where people spend most of their time. Knowing the geography of a region and locations of individuals in that region is key to disaster planning. In Pennsylvania, geographical traits that could be important factors in disasters include river systems, major highways, locations of nuclear facilities and hazardous waste sites, major industrial/population centers, and other unique features such as underground coal mines³³ and areas with significant radon problems.^{34,35} Based on Pennsylvania's history, certain disasters are periodically expected, such as major flooding, blizzards,³⁶ and tornadoes.³⁷ California and other coastal states can expect different disasters, such as earthquakes and mud slides.

In the United States, emergency management agencies are key agencies involved with disaster management. Public health agencies are essential in providing necessary technical support to these agencies. New developments in the computer field, such as the application of Geographic Information Systems^{38,39} technology, will enhance disaster management efforts at the local level.

Ecological Issues

Ecological approaches, including interdisciplinary efforts, are needed for epidemiological study of global hazards, including disasters.¹² There are numerous ecological issues, such as global warming,⁹⁻¹² that should be considered in disaster planning. Two key issues are population growth⁹⁻¹² and proper land-use management.^{6,14} A 1975 editorial on disaster epidemiology illustrated how the effects of disasters are escalating with population growth by highlighting the 1876 Bay of Bengal typhoon, which killed 100 000, and the 1970 East Bengal cyclone, which killed more than 200 000.⁴⁰ A major US concern is that residents continue to live in disaster-prone areas. For example, half of all US residents live within 50 miles of the Atlantic, Pacific, or Gulf coasts⁴¹ while many others live in flood-prone areas adjacent to major river systems or other high-risk areas. The costs of US disasters have also escalated. Many disasters that occurred over the last 5 years have been considered "megacatastrophes" because the insured losses associated with the events exceeded \$1 billion.⁴¹

Capacity Building, Training, and Collaboration

In 1981, there were only a few organized centers dedicated to disaster

study.³ Located in universities and other organizations in the United States, these included the Disaster Research Center, now situated at the University of Delaware; the Natural Hazards Research and Applications Information Center at the University of Colorado; and the American Red Cross. Many other organizations have recently been created. For example, the University of Wisconsin's Disaster Management Center has developed self-study courses in various disaster topics, including health issues. Many of these groups disseminate useful disaster information, as evidenced by the University of Colorado's recent directory of organizations dealing with disasters.⁴²

Extensive dedicated resources have also been allocated to public health aspects of disaster management, particularly at the international level. Collaborative research centers have been established under the sponsorship of the World Health Organization (WHO).⁵ The University of Louvain School of Public Health continues to support the Research Center on Disaster Epidemiology. Also, the International Decade for Natural Disaster Reduction proclamation for the 1990s has fostered national and international cooperation.³⁸ For example, the United Nations Department of Humanitarian Affairs and the Compania de Reaseguros/Madrid have developed a fellowship program on natural risk reduction for postgraduate students from developing countries to develop national capacity in this area. With support from five European universities, the European Community Humanitarian Office is also developing a program in disaster response, including course work in medicine and epidemiology. The Pan American Health Organization continues to serve as the regional WHO office and a major health resource for Latin American and Caribbean countries. This organization is involved with extensive and significant disaster management efforts and shares its activities through its newsletter. For example, the Pan American Health Organization and the National Aeronautics and Space Administration plan to implement a regional electronic communications network linking civil defense workers, health professionals, and others in Central America and other parts of the world.⁴³

Numerous federal agencies also participate in the public health response to disasters. For many years the CDC has supported disaster surveillance efforts, resulting in a major review of disasters⁴ in addition to periodic reports in its *Morbidity*

and Mortality Weekly Report. A Disaster Assessment and Epidemiology Section within NCEH actively fosters collaborative efforts in many areas. For example, it developed a natural disaster mortality and morbidity surveillance system in collaboration with the American Red Cross,⁴⁴ and it assisted with the medical disaster-response model following earthquakes.⁴⁵ And the NCEH's Emergency Response Coordination Group provides important public health support to other agencies in disaster planning and response. The National Institute of Mental Health, in cooperation with the Federal Emergency Management Agency, continues to fund and support mental health services following disasters.⁸ Other programs include the Office of Emergency Preparedness of the Public Health Service⁴⁶ and the National Disaster Medical System, including the Disaster Medical Assistance Team program.⁴⁷ Nevertheless, the overall federal public health response appears loosely organized and lacking a central coordinating unit.

Moreover, public health progress in the United States is still limited. A survey of US schools of public health was undertaken to assess the availability of public health curricula in disaster preparedness.⁴⁸ The survey, which was a follow-up to a 1991 policy statement adopted by the American Public Health Association urging public health professionals to take a lead role in disaster management,⁴⁹ demonstrated limited disaster preparedness training at these schools. Both the Emory School of Public Health and the CDC have recently joined forces in offering a public health course on disaster preparedness/management.⁵⁰ However, American universities in general have contributed little to psychiatric epidemiological studies of disasters.⁸

As illustrated in one commentary on the 1995 Japanese earthquake,¹⁸ organized and dedicated disaster resources sometimes "miss the mark." The reason why "acts of God" become disasters is because they negatively affect people who are at the wrong place at the wrong time. Some disasters cannot be avoided, even with the best of planning, but many are avoidable, especially by adhering to safe land-use plans for human settlement.

Conclusions

Recurring natural and technological disasters are environmental health hazards that will continue to affect public health adversely. In response, disaster

prevention activities must begin at the local level by communities and agencies implementing indicated disaster management policies, such as proper land-use planning, zoning, and siting. Promulgating and enforcing appropriate laws will also help protect home owners and the public from disasters.¹⁴ Academic institutions, including schools of public health, can enter into a partnership with governmental agencies and other institutions in support of disaster preparedness activities, focusing on the local or regional level. Public health monitoring of a descriptive nature should be implemented; this should include reviewing the historical record of disasters and associated mortality/morbidity for a region, projecting likely future events, and identifying sensitive populations, such as young children,⁵¹⁻⁵³ who live in high-risk geographic areas. Research already conducted by epidemiologists and others can serve as a foundation.^{3-8,14,30}

Environmental professionals with training in areas that may be predictive of disasters are also essential collaborators in disaster management. The importance of an interdisciplinary approach to studying global threats, including disasters, and adverse health outcomes cannot be overstated. The full extent of direct and indirect adverse health changes from such threats is an area wide open to study. For example, in addition to trauma-related mortality and morbidity, the 1994 Northridge earthquake caused excessive cardiovascular sequelae.⁵⁴ Epstein also recently pointed out that changes in the ecosystem may cause unusual increases in infectious diseases.⁵⁵ Monitoring health outcomes from disasters should include assessing all possible health sequelae in the affected populations.

Since the International Decade for Natural Disaster Reduction has now passed the halfway mark, the public health community needs to reflect on progress made to date and on possible new strategies and priorities for the future. Despite improvements in the public health response to disaster, a comprehensive federal or academic approach in the United States is still not evident, and the proper linkage to environmental health is lacking. Guidance is available on appropriate public health responses in the area of primary and secondary prevention.⁶ However, public health is meant to be an "action-oriented" discipline. Effective action in disaster management must include quality training provided by schools of public health and other academic centers, accurate and timely public education, comprehensive

assessment and surveillance by governmental agencies and other interested groups, and productive interdisciplinary collaboration. Our response to this challenge will have an important bearing on disaster risk reduction well into the future. □

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